

The Application and Impact of Virtual Reality Technology in Cultural Design in the Context of Globalisation—A Research Based on the PESTEL Analytical Model

Xiaowei Nie^{1,a}

¹Department of Human and Social Futures, The University of Newcastle Australia, 100 Victoria, Street #13-01/02, National Library Building, 188064, Singapore

^aXiaowei.Nie@uon.edu.au

Keywords: Visual Culture Communication, Virtual Reality, Cultural Design, PESTEL Analysis

Abstract: As the field of cultural design undergoes unprecedented changes, it is important to recognize the potential of Virtual Reality Technology to shape its future. This paper thoroughly examines the effects of globalisation on cultural design, with a specific emphasis on the function of creative media in promoting cultural intersections. Furthermore, it analyses how the emergence of Virtual Reality (VR) technology is transforming the practice and experience of cultural design. We will systematically evaluate the application of VR technology in cultural design and its potential impact on cultural experience and artistic creation across six dimensions: political, economic, social, technological, environmental, and legal, using the PESTEL analytical model.

1. Introduction

The introduction emphasizes the increasing value of culture as a national soft power in the context of advancing globalization. Cultural design plays a crucial role in conveying cultural values in our diverse world. With emerging media forms such as digital art, virtual reality, and augmented reality, designers have a broader creative space to work with. The rise of virtual reality technology offers exciting new possibilities for cultural design. Globalisation has facilitated the exchange and integration of different cultures, presenting both opportunities and challenges for cultural design. Creative media plays a crucial and decisive role in cultural communication. The rapid development of virtual reality technology has provided new and powerful ways of expression and immersive experiences for cultural design, which has far-reaching and significant impacts on traditional cultural design modes.

2. The Impact of Globalization on Cultural Design

The great changes in globalization are reflected in changes in cultural styles and cultural flows [1]. According to British sociologist Anthony Giddens (1938-) in his book 'The Runaway World', economic globalization has created a 'man-made risk' that surpasses the 'external risk' posed by nature, and has become a new source of uncertainty for the future of humanity[2].The interpenetration and

integration of different cultures, accelerated by the process of globalization, has led to the diversification of cultural design. Creative media is a powerful tool that bridges cultures and promotes cross-cultural communication and understanding through multimedia means such as images and sound.

Globalization has transformed the field of design from regionalism and tradition to pluralism and openness. The cross-cultural influence of globalization has fostered the pluralistic development of design vocabulary. As a result, a global design vocabulary has emerged, where design styles are no longer confined to traditional regionalism. Cultural design is a powerful tool for transmitting culture. By applying traditional Chinese culture to design while retaining its local essence, we can create a truly unique design style. This approach not only helps to preserve our cultural foundations but also prevents our cultural traditions from being forgotten in the face of globalization. Design has spread to countries around the world as a subsidiary value of trade products, even against the backdrop of the rapidly developing globalised economy. Cultural design is innovating within its heritage. The development of nationalized design is of utmost importance in the era of globalization. It is crucial to incorporate the essence of traditional national culture and create designs that reflect national characteristics while maintaining a global perspective. This approach not only enhances the global presence of national culture but also promotes cultural diversity. A prime example of this is Disney's film *Mulan*, which successfully reinterprets traditional Chinese stories while preserving their authentic elements. This film presents traditional Chinese cultural features to a global audience in a clear and concise manner through the use of modern production techniques and an innovative storyline.

3. The Application of Virtual Reality Technology in Cultural Design

Virtual reality technology enhances cultural experiences by simulating a three-dimensional environment. In the field of cultural design, VR technology is extensively utilized in museum exhibitions, historical relic reproduction, and virtual tourism, greatly enriching the form and content of cultural experiences.

Virtual Reality (VR) is an information technology that was developed in the 20th century. The origins of VR can be traced back to 1960 with Morton Heilig's invention of the multi-sensory simulation device called Sensorama. This device is considered to be a fixed version of today's head-mounted display (HMD). Virtual Reality (VR) technology provides users with realistic 3D visual, tactile, and sensory experiences. It integrates the development results of 3D image technology, multimedia technology, digital simulation technology, and other high-tech fields. The integration of media art and digital technology has diversified digital media art design and expanded spatial limitations. However, the traditional mode of digital media art may no longer meet current design concepts and needs. The introduction of virtual reality technology into the process of digital media art design has resulted in a significantly more diverse and impactful artistic effect in terms of both content and form. This expansion of creative possibilities provides an exciting and promising development space for the future of art design.

3.1. Virtual Reality Presentation in Museums and Exhibitions:

Virtual reality technology offers a unique cultural experience by combining immersion and interactivity [3]. The immersive experience is not only derived from the traditional spatial layout of lighting, exhibits, furnishings, and other external sensory elements. It provides the viewer with a realistic sensory experience that goes beyond mere cognitive processing, allowing for a deep immersion in the exhibit's design elements. Visitors can explore various exhibition halls and view valuable artefacts and relics using head-mounted or other interactive devices in a virtual museum.

This immersive visual space transforms the viewer from a spectator to a protagonist, providing a completely new exhibition experience. The Guggenheim Museum in New York has collaborated with the Google Cultural Institute to enable people to explore the museum virtually through their own computers or virtual reality viewers [4] (Mir, 2016). The museum exhibition design has been enhanced with virtual reality innovations such as interactive displays, holographic projections, and virtual interpretation. The Palace Museum utilized virtual reality to provide a 360-degree panoramic view of its buildings, accompanied by an online audio guide and a video introduction to significant artifacts.

3.2. Virtual Reality Reproduction and Preservation of Cultural Heritage

Virtual reality technology is essential in protecting and restoring cultural heritage. It encompasses historical, scientific, and artistic artifacts and activities that hold significant value and representation. Unfortunately, various reasons put many cultural heritages at risk of being lost. It enables conservators to conduct more accurate and sustainable conservation while minimizing disturbance to physical artifacts [5]. Moreover, the digital presentation form can more effectively capture the attention of young people and enhance their comprehension of traditional culture. Virtual reality technology plays an irreplaceable role in cultural heritage protection.

3.3. Application of Virtual Reality in the Fields of Education, Training and Cultural Communication

Virtual reality is a valuable tool in education, offering a more vivid and intuitive learning experience. Virtual reality technology has been increasingly used in education, particularly in the development of virtual simulation laboratory teaching. Through VR programmes, laboratory work has shifted from being space-oriented to equipment-oriented. This means that students can have their own virtual equipment and are not limited by the availability of physical laboratories. This has led to increased effectiveness in practical applications of virtual reality technology for research and learning purposes. Virtual reality education in China has seen significant advancements in the last decade, with a particular focus on virtual reality technology, virtual simulation laboratory teaching, augmented reality, and artificial intelligence [6].

The tourism industry in China has also benefited from the application of virtual reality, with a focus on enhancing tourist attractions and cultural heritage protection. The virtual tourism system enables individuals to explore stunning scenery without the constraints of time and space. Additionally, it offers a novel approach to showcasing tourist attractions. In 2016, China Eastern Airlines confidently provided virtual reality headsets for passengers to enjoy virtual tourism products. Furthermore, the digital technology available at Yuanmingyuan enables tourists to easily understand the historical development of the scenic spot, saving valuable time. Virtual reality technology can recreate disappeared human civilizations, such as simulating the Afang Palace. This provides tourists with a more intuitive understanding of the palace, rather than relying solely on mental images. The rapid development of new media is a major force that accelerates the trend of globalization in human society. Virtual reality technology offers new creative opportunities for the media. It is a powerful platform for global cultural exchange. With virtual social and collaborative tools, people can share cultural experiences, display works of art in virtual environments, and promote in-depth understanding between different cultures [7].

4. Detailed Assessment Based on the PESTEL Analytical Model

The PESTEL model is a framework for analysing macro-environmental factors and is commonly

used to assess the impact on the strategy and operations of a business or organisation. The framework was first proposed by the British scholar Francis J. Aguilar and first mentioned in his book "Scanning the Business Environment" published in 1972. PESTEL model is listed as one of the important tools for business strategy analysis. The PESTEL model is classified as one of the most important tools for business strategy analysis. By systematically analysing political, economic, social, technological, environmental and legal factors, it is possible to better understand the opportunities and threats in the external environment, so as to adjust strategies, make decisions and deal with potential risks. The validity and practicability of the PESTEL model has made it an indispensable part of many companies' strategic planning and decision-making processes.

4.1. Political Dimension

The government's policy of supporting the cultural industry and the strategy of foreign cultural exchange have played a positive role in promoting the application of VR technology in cultural design. By formulating relevant policies and providing financial support, the government encourages innovation and technology application, creating a favourable political environment for the development of VR technology in the field of cultural design. The Chinese government has actively promoted the use of emerging technologies in the industry. For example, in April 2016, China's Ministry of Industry and Information Technology (MIIT) released a white paper on the development of the virtual reality industry, supporting the industrialisation of VR technology through special financial allocations. In addition, cultural exchanges and co-operation between governments also provide opportunities for the promotion and application of VR technology on a global scale.

4.2. Economic Dimension

Market demand and consumer purchasing power are economic drivers for the application of VR technology in cultural design. As people's demand for cultural experience becomes increasingly diversified, traditional cultural design methods can no longer meet the market demand. And VR technology, with its unique immersive experience, brings new consumer hotspots for cultural design. At the same time, with the development of the economy and the improvement of consumers' purchasing power, more and more consumers are willing to pay for high-quality VR cultural experience, which further promotes the application of VR technology in cultural design. According to data from the National Bureau of Statistics, statistics show that the market scale of the VR industry reached nearly 6 billion RMB in 2016. Due to the high development cost of VR tourism products and the production of VR content, the final price is expensive. Regional imbalances in the level of industry development may also hinder the popularity of VR tourism products. IDTechEx, a US market research company published a study highlighting the ongoing innovations in the field of virtual reality technology, which predicts that the virtual reality technology market will reach \$37 billion by 2027 [8].

4.3. Social Dimensions

The socio-cultural context, audience acceptance and education level have a significant impact on the popularity and acceptance of VR technology in cultural design. In different socio-cultural contexts, there are differences in people's perception and acceptance of VR technology. Therefore, when applying VR technology, cultural designers need to fully consider the cultural background and acceptance of the target audience and design VR cultural products that meet their needs and preferences. In addition, the improvement of education level also helps to improve people's cognition and understanding of VR technology, thus promoting its application in cultural design.

4.4. Technological Dimension

Technological innovation and equipment development are crucial factors that underpin the successful application of VR technology in cultural design. As technology continues to progress and innovate, VR equipment performance has improved significantly, while prices have gradually decreased. This has enabled more cultural design organisations and individuals to access and utilise VR technology with ease and confidence. The development of internet infrastructure provides the necessary network support for the implementation of VR technology in cultural design. With the popularisation and advancement of 5G and other new-generation communication technologies, the application of VR technology in cultural design will have an even wider scope in the future.

4.5. Environmental Dimension

The concept of sustainable development and environmental regulations necessitate the green application of VR technology in cultural design. It is crucial to fully consider the impact of VR technology on the environment and resource consumption. Optimizing algorithms and minimizing equipment power consumption can significantly reduce energy consumption. Similarly, using renewable materials and environmentally friendly packaging can help reduce waste generation. To successfully apply VR technology in cultural design, it is imperative that both the government and enterprises prioritize the promotion and education of environmental protection awareness.

4.6. Law Dimension

This will not only improve people's understanding and attention towards the green application of VR technology, but also ensure that legal constraints such as intellectual property protection, data security, and privacy regulations are taken into account. Respecting the intellectual property rights of original works is crucial when utilising VR technology to avoid infringement. Strengthening data security and privacy protection measures is also essential to prevent the leakage and misuse of user information, given the significant user data and information interaction involved in VR technology. The government and enterprises must establish a comprehensive system of laws and regulations to govern the use of VR technology in cultural design and safeguard the interests of all parties involved. Compliance is absolutely essential for the development and market access of virtual reality technology. The '13th Five-Year Plan for National Science and Technology Innovation', officially issued by the State Council in August 2016, highlights the importance of cutting-edge technologies such as artificial intelligence and virtual reality. The plan underscores the exemplary role of VR technology in various industries, including industry, healthcare, entertainment, and tourism. VR technology can be effectively demonstrated in these industries.

5. Conclusion

VR technology enhances cultural experiences and inspires artists creatively. Artists can create works that transcend reality and challenge the boundaries of traditional art creation using virtual reality. Artists can create works that transcend reality and challenge the boundaries of traditional art creation using virtual reality. This provides audiences with a new aesthetic experience. Artists can create works that transcend reality and challenge the boundaries of traditional art creation using virtual reality. Virtual reality technology eliminates geographical and linguistic barriers, facilitating cultural exchanges. It provides an equal platform for diverse cultural expressions, promoting cultural diversity. Artists, creators, and cultural inheritors can display and share their cultural treasures through virtual reality, promoting global cultural exchange and sharing. It is clear that VR

technology has the potential to revolutionize cultural design, and with careful consideration of its challenges, we can harness its power to create a better future.

In conclusion, the application and impact of virtual reality technology in cultural design within the context of globalization is a complex and multidimensional issue. However, the PESTEL analysis model provides a comprehensive assessment, revealing that VR technology presents both opportunities and challenges across various dimensions. VR technology will undoubtedly play an increasingly important role in cultural design. As technology progresses and market demand grows, it will provide people with more diverse cultural experiences and forms of artistic creation. It is crucial to consider the ethical and moral implications of VR technology and proactively seek solutions to ensure its healthy and sustainable development. In the future, global cultural design will prioritize innovation and cross-cultural integration. Creative media can act as a bridge to facilitate intercultural exchange. Virtual reality technologies are expected to provide more engaging and interactive environments for cultural design. Strengthening international cooperation and promoting closer exchanges and cooperation between the cultural and creative industries will help achieve this vision.

References

- [1] Pieterse, J.N., "Globalization and culture: Global *mélange*", Rowman & Littlefield, (2019) 81-83.
- [2] Li, T., Han, P., "The Development of contemporary Art and Product Design under the wave of globalization", *Silk screen printing* (22) (2023) 62-64. DOI: 10.20084/j.cnki.1002-4867.2023.22.018.
- [3] Chee, F., "Online games as a medium of cultural communication: An ethnographic study of socio-technical transformation [Doctoral Dissertation]", Fraser University (2012) 27-28.
- [4] Carrozzino, M., Bergamasco, M., "Beyond virtual museums: Experiencing immersive virtual reality in real museums", *Journal of cultural heritage* 11 (4) (2010) 452-458.
- [5] Mir, R., "Extending the Museum Experience with Virtual Reality", *Zugriff am* (26) (2020).
- [6] Abokhoza, R.R., Sobieh, Y.M., "The Role of Virtual Reality to Enhance Cultural Communication", *International Journal of Web Portals (IJWP)* 13 (2) (2021) 20-35.
- [7] Zhong, H., Wang, L., & Zhang, H., "The application of virtual reality technology in the digital preservation of cultural heritage", *Computer Science and Information Systems* 2(18) (2021) 535-551.
- [8] Liu, D.Q., "American Technology report predicts the future development direction of Virtual Reality Technology", *Dual-use Technology and Products* (23) (2017) 05-05.